MANAGING GREENHOUSE GAS EMISSIONS: STRATEGIES AND DEVELOPMENTS IN AUSTRALIA

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ABSTRACT

Australia is only a minor contributor to greenhouse gas (GHG) emissions globally but is a major contributor on a per capita basis. Owing to its dependence on coal-fired electricity generation, its energy intensive industries such as mining, aluminium, iron and steel, as well as its agriculture and land clearing practices, Australia's GHG emissions have already risen to 111% of the baseline 1990 levels. Consequently the Australian Government has moved from its previous 'no regrets' GHG abatement policies to issue new initiatives ranging from incentives and assistance programs on renewable energy, energy efficiency and alternative fuels, to a mandated target of 2% increase in renewable-based power generation (from 10% to 12%). Given the Government commitment of almost AUD$1 billion over four years, these programs focus on the implementation of technologies available in the short-term rather than funding major long term development of new GHG abatement technologies.

INTRODUCTION

Australia, a large land mass approximately the area of continental USA containing about 19 million people, is rich in minerals and agricultural resources. It exports each year substantial quantities of raw and semi-processed minerals and metals as well as agricultural products. As a consequence of these factors, its energy use is high; for example, its electricity generation has increased from 155 TWh in 1990 to 179 TWh in 1998, with a further projected increase of over 40% by 2010. Australian energy use by source is shown in Table1.

Greenhouse gas emissions worldwide exceed 41,000 million metric tons (tonnes) CO_2 equivalent annually, of which Australia's contribution is very small, about 1.4%. However, on a per capita basis at 26.7 tonnes CO_2 equivalent, Australia is amongst the highest emitters, 25 % higher than the USA and 2-3 times the annual per capita emissions of other developed countries, e.g. Germany at 12.6 tonnes. Further, by 1996, greenhouse gas emissions in Australia had increased to 111% of its 1990 baseline levels, already exceeding the emission target of 108% of 1990 baseline levels assigned at the Kyoto Greenhouse Summit in December 1997.

Australia in 1992 implemented a National Greenhouse Response Strategy, involving the voluntary cooperation and input by different levels of government, industry and the community for pursuing reduction of greenhouse gas (GHG) emissions. Shortly before the Kyoto meeting Australia moved from this "no-regrets" voluntary approach, e.g. the Greenhouse Challenge Agreement, to a more proactive strategy to combat and control the rising greenhouse gas emissions. In November 1997, the Prime Minister, Hon. John Howard announced a major policy statement entitled, *Safeguarding the Future: Australia's Response to Climate Change*, that included a AUD$180 million package for addressing climate change and GHG emission issues. Since this announcement the Australian Government has expanded its initiatives and funding, to near AUD$1 billion over 4-5 years, for a range of GHG emissions reduction projects.

This paper highlights various Government initiatives and programs. It also provides insight into selected key projects aimed at arresting Australia's continuing rise in CO_2 emissions.

GREENHOUSE ABATEMENT POLICIES/PROGRAMS

Underlying Australia's greenhouse abatement policies are the following premises:

1. Australia's competitive position in international markets should not be disadvantaged by policies and measures to reduce GHG emissions
2. Nuclear power is not a politically acceptable option in the short to medium term based on prevailing community attitudes.

The November 1997 Statement highlighted a range of financial incentives for energy efficiency and renewable energy programs along with mandating a 2 % increase in power generation from 'new' renewable energy sources. These policies and programs have subsequently been supplemented and expanded. The Australian Greenhouse Office (AGO) was formed to coordinate and implement the various greenhouse programs and measures, including the National Greenhouse Strategy (NGS).

Programs now being supported by the Australian Government include:

- Greenhouse Challenge – an expanded registry of companies, organizations and government authorities giving voluntary commitments to reduce their GHG emissions
- Renewable Energy Showcase Projects
- Renewable Energy Commercialisation Program
- Household Photovoltaic Scheme
- Alternative Fuels Conversion Program and Diesel Fuel/Alternative Fuels Grant
- Cities for Climate Protection™
- Efficiency Standards for Power Generation
- Bush (i.e. Outback) for Greenhouse
- International Greenhouse Partnerships (previously Activities Implemented Jointly)

The measure requiring a 2% increase in the use of 'new renewables' for power generation over existing levels by 2010 has also been strengthened to include a penalty of AUD$40/MWh for non-attainment of the target.

The State and Local governments in Australia, having a degree of autonomy on energy and GHG matters, have strongly supported the Australian Government national programs as well as initiating State programs such as:

- The Green Power Program offering higher priced but renewables-based electricity
- Cogeneration and biomass generation incentives
- Energy efficiency labeling for household appliances
- Energy Smart programs and awards for companies, schools and other organizations

While the impact of these measures is difficult to quantify, there is general agreement that more action is required if Australia is to achieve its GHG targets. Carbon credit trading is an additional measure that various jurisdictions see as having potential to assist Australia meet its Kyoto obligations. The AGO has issued four discussion papers on the topic and is assessing the responses. Meanwhile the Sydney Futures Exchange is setting up electronic trading systems for a carbon credit market.

A major element of carbon trading schemes in Australia is sequestration credits from forestry activities. Forestry is largely a State responsibility and these carbon credit schemes vary from State to State. However, most State governments are actively pursuing forestry management programs and encouraging investment in future carbon sequestration credits. For example, TEPCO of Japan has significant forestry investments in NSW and Tasmania.

The Australian Government has also recently announced a model for a greenhouse trigger that would apply to actions or development projects that are likely to generate GHG emissions of over 500,000 tonnes of CO_2 equivalent in any 12 month period. This trigger could be applied under the Commonwealth's new Environment Protection and Biodiversity Act 1999. The proposed emissions threshold corresponds to approximately 10% of the average annual rise in Australia's total GHG emissions (1).

The current emphasis of the Australian Government funded greenhouse abatement programs is in maximising reductions in GHG emissions via demonstration, commercialisation and enhanced market acceptance of available or near-term renewable energy and energy efficiency technologies. A more detailed report summarising the various programs and including pertinent web sites, has been published elsewhere (2).

RENEWABLE ENERGY DEVELOPMENTS

2% Renewable Energy Target: The mandated 2% Renewable Target has been defined as 9500 GWh (about 2800MW) of green power that electricity suppliers are required to obtain from new renewable sources. Currently some 10 % of Australia's electricity is generated from renewable sources. Table 2 gives a breakdown of renewable energy sources for 1998

Beginning in 2001 with an additional 400 GWh of new renewables-based electricity, the measure will be phased in steps reaching 9500 GWh in 2010. As a minimum, the target amount is to be maintained through the period 2010-2020.

This 2% Target measure has already provided a significant boost to developing the renewable energy industry in Australia, and could stimulate at least AUD$2 billion investment. Hence it is a major driver to develop new renewable energy sources for reducing GHG emissions.

SWERF Waste-to Energy Facility in NSW: Energy Developments Limited (EDL) is constructing a Solid Waste Energy Recycling Facility (SWERF) in Wollongong, NSW following a Renewable Energy Showcase Grant of $2 million from the AGO. Based on 10 years development, the SWERF project will convert household trash to 'green' electricity with the potential for consuming 90% of the waste collected by Wollongong City Council currently going to landfill. Assuming a yield of 85% organic pulp (putrescibles, organics, paper, plastic), it is estimated that 100 tonnes of municipal solid waste will generate 90 MWh of electricity (3).

The EDL facility, costing AUD $10 million for initial development, has been designed to separate recyclable materials, such as metals and glass, from unsorted household garbage and gasify the organic-based remainder using the Brightstar Environmental gasification technology. The gas is burned in reciprocating engines to generate electricity that is sent to the grid. The facility, having four 1.35 MW Gen-sets currently, is to be commissioned in July-August 2000. This demonstration phase will process some 20,000 tonnes per annum and, depending on a successful outcome, will be followed by two more distinct phases - 75,000 tonnes per annum and 150,000 tonnes per annum. The latter will generate up to 16 MW of electricity and substantially reduce the pressure on landfill sites.

Landfill-Gas to Electricity: EDL also operates 16 landfill-gas power generation facilities around Australia with a combined capacity of 72 MW. The conversion into electricity of methane gas resulting from anaerobic digestion of organic refuse avoided the release of 1.84 million tonnes of CO_2 in the 1998-99 financial year.

Bagasse/Wood Waste Generation: The construction of Australia's largest biomass project, costing AUD$50 M, at Rocky Point Sugar Mill, Queensland, is scheduled for May 2000. The completed facility is to generate 30 MW of 'green" electricity from bagasse (typically 20-weeks sugarcane crushing season per year) and wood waste/green waste for use by consumers as well as steam and electricity for industrial users including the sugar mill and a nearby ethanol distillation plant.

The project is being jointly developed by the Heck Group (Rocky Point Sugar Mill owners) and Stanwell Corporation (power generator) supported by an AGO Showcase Grant of AUD $3 million (4).

BP Solar Olympic Athletes Village: BP Solar, now BP Solarex following the merger of BP Oil with Amoco, is completing the installation of a 1 kW solar cell on each roof of the 650 houses at the Athletes Village for the 2000 Olympics in Sydney. The 12 solar laminates on each roof incorporate BP Solarex's high efficiency (17 %) Laser Grooved Buried Grid mono-crystalline technology.

In Australia, BP Solarex manufactures solar cells from multi-crystalline and mono-crystalline technology. The Solarex facility in 1999 received a Renewable Energy Commercialisation Grant of AUD $482,000 to upgrade its multi-crystalline solar cell fabrication facility (4). By the end of year 2000, the company will be producing 13 MW of solar cell panels from it Sydney factory, with a projected output of 20 MW by the end of 2001.

CONCLUSIONS

The Australian Government has made a major commitment of almost $1 billion towards achieving its Kyoto obligations through its financial support of diverse renewable energy and energy efficiency programs. The focus of the programs is on maximising reductions in GHG emissions via the demonstration, commercialisation and improved market acceptance of renewable energy and energy efficient technologies.

It is widely accepted that further measures will be needed for Australia to achieve its Kyoto targets. Options could include carbon credit trading, setting efficiency targets for major GHG emitters, and minimising the GHG impact of major development projects.

At this stage, there is no substantial government funding of high risk R&D projects as is common in USA, Japan and Germany. The Australian Government, however, supports fundamental greenhouse research activities through several CSIRO Divisions (e.g. global warming and climate change at the Division of Atmospheric Research; carbon fixing in forests and crops at the Division of Forestry) and various Cooperative Research Centres (e.g. CRC for Greenhouse Accounting; CRC for Renewable Energy; CRC for Clean Power from Lignite).

Increased joint government and industry funding of innovative technical solutions will be required to make further reductions in GHG emissions from Australia's particular energy generation and resource use as we move closer towards the Kyoto target dates of 2008-2012 and beyond.

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Table 1. Australian Energy Use 1997-1998*

Source	Amount (%)
Crude oil	34
Black coal	29
Brown coal	13
Natural gas	18
Renewables	6

*Source: ABARE (5)

Table 2. Mix of Renewable Energy sources in Australia in 1998*

Source	Capacity (MW)	Generation (GWh)
Large hydro	7580	16,000
Small hydro	200	700
Biomass	330	800
Landfill gas	15	20
Sewage gas	49	90
Black liquor	6	40
Wind	2.7	4.8
Grid photovoltaic	0.14	0.3
Solar thermal	0.045	<1
Remote area power systems	14	<2
TOTAL	**8,200**	**17,700**

*Source: ESAA data (6)